

Investigation

2

Adding and Subtracting Integers

In Investigation 1, you used number lines and chip boards to model operations with integers. Now, you will develop algorithms for adding and subtracting integers.

An **algorithm** is a plan, or series of steps, for doing a computation. In an effective algorithm, the steps lead to the correct answer, no matter what numbers you use. You may even develop more than one algorithm for each computation. Your goal should be to understand and skillfully use at least one algorithm for adding integers and at least one algorithm for subtracting integers.

2.1

Introducing Addition of Integers

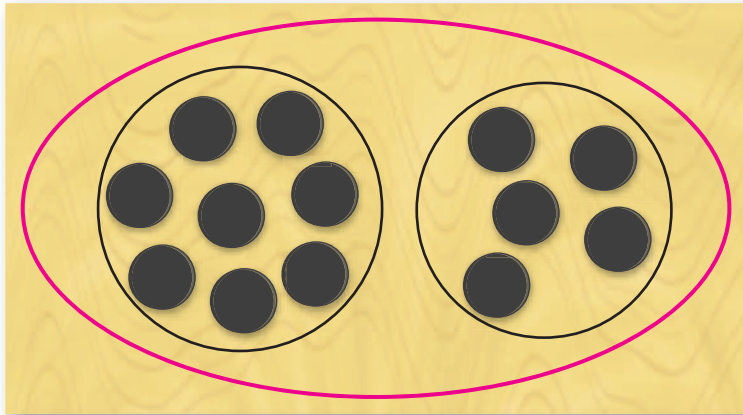
There are two common ways that number problems lead to addition calculations like $8 + 5$. The first involves combining two similar sets of objects, like in this example:

John has 8 video games and his friend has 5. Together they have $8 + 5 = 13$ games.



You can represent this situation on a chip board.

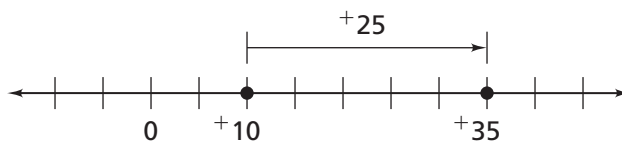
$$8 + 5 = 13$$



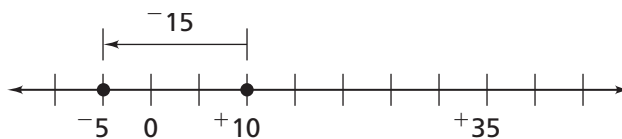
Number problems also lead to addition calculations when you add to a starting number. Take the following example:

At a desert weather station, the temperature at sunrise was 10°C . It rose 25°C by noon. The temperature at noon was $10^{\circ}\text{C} + 25^{\circ}\text{C} = 35^{\circ}\text{C}$.

You can represent this situation on a number line. The starting point is $+10$. The change in distance and direction is $+25$. The sum ($+35$) is the result of moving that distance and direction.



Suppose, instead of rising 25°C , the temperature fell 15°C . The next number line shows that $+10^{\circ}\text{C} + -15^{\circ}\text{C} = -5^{\circ}\text{C}$.



Use these ideas about addition as you develop an algorithm for addition of integers.

Problem 2.1 Introducing Addition of Integers

Use chip models or number line models.

- A.** 1. Find the sums in each group.
 2. Describe what the examples in each group have in common.
 3. Use your answer to part (2) to write two problems for each group.
 4. Describe an algorithm for adding integers in each group.

Group 1
$+2 + +8$
$-3 + -8$
$+20 + +25$
$-24 + -12$

Group 2
$+8 + -12$
$-3 + +2$
$+14 + -23$
$-11 + +13$

- B.** Write each number as a sum of integers in three different ways.

1. -5 2. $+15$ 3. 0

4. Check to see whether your strategy for addition of integers works on these rational number problems.

a. $-1 + +9$ b. $-1\frac{1}{2} + -\frac{3}{4}$ c. $+1\frac{1}{2} + -2\frac{3}{4}$

- C.** Write a story to match each number sentence. Find the solutions.

1. $+50 + -65 = \blacksquare$ 2. $-15 + \blacksquare = -25$ 3. $-300 + -250 = \blacksquare$

- D.** Find both sums in parts (1) and (2). What do you notice?

1. $+12 + -35$ $-35 + +12$ 2. $-7\frac{2}{3} + -1\frac{1}{6}$ $-1\frac{1}{6} + -7\frac{2}{3}$

3. The property of rational numbers that you have observed is called the **Commutative Property** of addition. What do you think the Commutative Property says about addition of rational numbers?

ACE Homework starts on page 32.

2.2 Introducing Subtraction of Integers

In some subtraction problems, you *take away* objects from a set, as in this first example:

Example 1 Kim had 9 CDs. She sold 4 CDs at a yard sale. She now has only $9 - 4 = 5$ of those CDs left.